conductive coating to the surface of said refractory core such that said bonding material does not surround said elemental carbon, individually or in the aggregate, in said electrically conductive coating thereby allowing said elemental carbon to make electrical contact with a separate electrically charged element in the system.

REMARKS — General

The above amendments reflect the agreements made between the applicant and the Examiner during a telephone interview dated 29 April 2005. The substance of that interview, as recorded by the Examiner and communicated to the applicant in the Interview Summary is as follows:

> "It was agreed that by limiting the claims to a stopper, rather than a general refractory article, the rejections of the claims over Rickborn would be obviated. It was also agreed that amendments/arguments stressing that while LaBate has a coated refractory article where the coating includes graphite, the penetration of the coating layer into the refractory substrate, as well as the additional elements other than elemental carbon in the coating provide much poorer electrical conductivity than that provided by the elemental carbon coating of the instant claims."

By the above amendment, applicant has amended the title to reflect the cancellation of claims 1-10 and to emphasize the novelty of the invention.

Also applicant has canceled claims 11-20 and substituted claims 21 to 30 to define the invention more particularly and distinctly so as to overcome the technical rejections and define the invention patentably over the prior art.

Claims 1-10 are canceled to obviate the rejection under 35 U.S.C. 102(b) over Rickborn. This cancellation limits the invention to a refractory stopper which, as agreed, obviates the rejection of claims over Rickborn. This also overcomes the objections of claims 9 and 10 under 37 CFR 1.75(c), the rejection of claims 1, 2 and 5-10 under U.S.C. 102(b) as being anticipated by LaBate, and the rejection of claims 3 and 4 under U.S.C. 103(a) as being unpatentable over LaBate.

Claims 11-20 are canceled and replaced with claims 21 to 30 to overcome Examiner's objections under 37 CFR 1.75(c).
Claims 21 to 28 are the same as 11 to 18. The applicant has substituted rewritten claims 29 and 30 for claims 19 and 20. These were rewritten so as to recite structure rather than method of manufacture and place the claims in proper dependent form and overcome the Examiner's objections under CFR 1.75(c).

LaBate does not teach the invention of the instant claims and therefore should not be rejected under U.S.C. 103(a) over LaBate.
Additionally, applicant will respectfully present arguments supporting applicant's position that the coating in LaBate does not teach the invention of the instant claims nor will the coating in LaBate conduct electricity which is the novel structure of the applicant's invention. These arguments are presented in full detail in the ***REMARKS - Specific*** section of this Amendment.

REMARKS - Specific

The following are presented in the order they appear in the Office Action Summary mailed 04/07/2005.

Page 2: Claim Objections

Claims 9, 10, 19 and 20 are canceled and/or rewritten to overcome Examiner's objections under 37 CFR 1.75(c)

Claim 9 is canceled.

Claim 10 is canceled.

Claim 19 is canceled and rewritten as claim 29.

The rewritten claim recites the structural novelty of the bonding material to affix the coating to the surface of the refractory core at temperatures below 950 degrees Fahrenheit and to maintain that bond at metal casting temperatures that would be above 950 degrees Fahrenheit. Thus, the method by which this is achieved is replaced by the resultant structure that is achieved.

The 950 degree Fahrenheit is a critical temperature where carbon and graphite materials begin to oxidize at an accelerated rate. By claiming this novel structure, the coating is limited to a coating that is not produced at high temperatures in controlled atmospheres in order to prevent oxidation of the elemental carbon in the coating as disclosed in the prior art of the Examiner's first citation — Rickborn (#4,686,116).

Also, this novel structure wherein the bond continues to affix the coating to the surface of the refractory core at temperatures greater than 950 degrees Fahrenheit defines a structure different from that of the Examiner's second citation — LaBate (#4,630,667) which contains

considerable organic binders. These organic binders would be rendered ineffective as a bonding mechanism at temperatures above 950 degrees Fahrenheit.

Finally, LaBate teaches a penetrating coating quite different from the applicant's instant claim 29 that claims a surface coating. The structural deposition of the coating on the surface of the refractory core is an essential structural element in its ability to function as a means for conducting electricity. A function unnecessary and not claimed and not achieved by LaBate.

Thus, claim 19, now rewritten as claim 29, recites a novel structure that limits the electrically conductive coating of claim 27 to that of a bonded coating that is affixed to the surface of the refractory core. This language distinguishes over LaBate under Section 102 because LaBate recites a coating that penetrates the refractory. This distinction is submitted to be of patentable merit under Section 103 because a penetrating coating will not effectively conduct electricity.

Claim 20 is canceled and rewritten as claim 30.

The rewritten claim recites the novel structure of the bonding material to affix the coating to the refractory core without surrounding or encapsulating the elemental carbon in the coating. This allows the surface of the elemental carbon to make electrical contact with itself and other electrically charged elements in the system. Thus, by amending the claim to define the structure of the bond, rather than the method by which the structure is achieved, one aspect of the Examiners objection is satisfied.

As to another aspect of the Examiner's objection that because the "stopper is already electrically conductive...they are already inherently capable of making electrical contact with another electrically charged element and therefore... Do not fairly further limit independent claims... 11." This is best explained with an example of a typical household electrical wire. The wire is capable of conducting electricity, but because it is surrounded by a plastic coating which is not electrically conductive, it is not capable of making an electrical contact along its length.

In the coating of the instant claims, the bond is not electrically conductive (plastic clays and/or bentonite). In order to conduct electricity, the coating must be structured to allow contact between carbon elements in the coating. If non conducting bonding materials surround the carbon elements individually, it would prevent the coating from conducting electricity. However, it is possible that the bonding material will allow carbon to carbon contact in the coating, but surround the coating in the aggregate much like a plastic coating on an electrical wire. This would allow the coating to conduct electricity, but it would effectively prevent the conductive coating from making electrical contact with external elements in the system. This is a distinction that the Examiner did not recognize in the language of the original claim and the claim is rewritten so as to make this distinction more clear.

Thus, claim 20, now rewritten as claim 30, recites a novel structure that limits the bonding structure of the coating in claim 29 to that which does not surround the elemental carbon in the coating. This language distinguishes over LaBate under Section 102 because LaBate recites a

coating that contains an electrically nonconducting bonding material in sufficient quantity to surround and encapsulate the graphite materials in the coating rendering the coating electrically nonconducting. This distinction is submitted to be of patentable merit under Section 103 because the bonding materials described in LaBate are not conducive to an electrically conductive coating.

Page 3: **Claim Rejections -- 35 USC § 102**

Claims 1-10 are canceled which obviates the rejection of claims over Rickborn.

Claim 1, 2 and 5-10 are canceled which obviates the rejection of claims over LaBate.

Page 3: **Claim Rejections -- 35 USC § 103**

Claims 3 and 4 are canceled which obviates the rejection of these claims over LaBate.

Independent Claim 1 is canceled which obviates the rejection of claim 1 over LaBate.

The Examiner's general rejection, as applied to claim 1, that "LaBate teaches that it was known in the art at the time the invention was made to coat refractory articles employed in molten metal operations, including...with a graphite coating in order to reduce flaking..." is obviated by the cancellation of claim 1.

Claims 11-20 are canceled and rewritten as claims 21 to 30.

The Examiner has rejected Claims 11-20, now rewritten as 21 to 30, as being unpatentable over LaBate under 35 U.S.C. 103(a). The applicant will demonstrate that the specific novelty of LaBate teaches a coating that, while effective at

preventing flaking, is totally ineffective at conducting electricity. The coating referenced in LaBate is contrary to that of the applicant's invention and solves a different problem. Additionally, the novelty of the instant disclosure was not obvious to those skilled in the art because they have not implemented it even though the process in which it is utilized has been in operation for more than twenty years. For these and other reasons to be cited, the applicant believes his invention is not obvious and is patentable over LaBate.

Applicant's invention solves a different problem than that of LaBate. The coating of LaBate solves a different problem than that of the applicant's invention. LaBate's coating is designed to transfer heat into the refractory to reduce thermal flaking, called spalling in the foundry trade. This flaking occurs when large heat gradients occur between the surface of the refractory and the interior of the refractory. The instantaneous contact of molten metal (2800 degrees Fahrenheit) on the surface of a room temperature (70 degrees Fahrenheit) refractory would create such a gradient.

LaBate mitigated this thermal gradient by coating the refractory with a thermally conductive material such as graphite. However, in order for the coating to work it must be "...capable of penetrating the refractory surface..." (LaBate, column 1, line 46). This penetrating requirement of LaBate's coating is further emphasized in column 3, lines 15-24.

Since graphite is an excellent thermal conductor, its presence **in the refractory** would increase the thermal conductivity of the refractory which reduces the thermal gradient in the refractory and thus reduces flaking.

However, if the graphite failed to penetrate the refractory, there would be no increase in the thermal conductivity within the refractory. Therefore, LaBate emphasized that his coating "...comprise an effective wetting agent which contributes to the ability of the particles of colloidal graphite to penetrate the refractory material..."

There is no attempt by LaBate to make the refractory, either internally or externally, an electrically conductive body. The sole purpose of LaBate is to convert a thermally nonconductive refractory into a thermally conductive refractory by penetrating it with graphite.

LaBate teaches a penetrating coating structurally different from the applicant's surface coating. Thus, the applicant's invention distinguishes over LaBate under Section 102 because LaBate recites a coating that penetrates the refractory. This distinction is submitted to be of patentable merit under Section 103 because a penetrating coating, while an excellent heat conductor, will not effectively conduct electricity.

LaBate teaches a contrarian invention than that of the instant claims.
The more the graphite penetrates the refractory the more thermally conductive the refractory becomes and the less electrically conductive the surface becomes. Experiments with various coatings indicate that, where the objective is electrical conductivity, the less penetration the better which is the opposite goal of LaBate. This is also alluded to in the disclosed prior art of the applicant (Pallilla, #4,487,733) where Pallilla observed that a loss of graphite from the surface of a ceramic-graphite blended refractory rendered it electrically nonconductive.

LaBate teaches a penetrating coating which would deplete the amount of graphite on the refractory surface and is contrary to the teaching of the applicants invention and makes the refractory an ineffective electrical conductor. Those skilled in the art seeking to implement LaBate would not readily recognize the electrically non-conducting consequence of the structure of LaBate's coating.

LaBate does not suggest the modifications in applicants invention.

Heat can be transferred by three mechanisms: conduction, convection and radiation. Because of this multitude of mechanisms, heat transfer does not require particle-to-particle contact. This is not true of electrical conductivity. The flow of electricity requires that electrically conductive elements in the system be in contact with one another. Only in the case of extremely high voltages will electricity bridge an insulating gap such as air or plastic or an organic nonconducting binder.

In LaBate, the coating composition lists graphite as a minor constituent (column 2, line 55, 10 percent and column 3, line 6, 5-25 percent). It is unlikely that this coating would have the continuity of graphite particle-to-particle contact to facilitate electrical conductivity. The applicants experience indicates that coatings with 50 percent or less of electrically conducting material such as carbon/graphite had little or no electrical conductivity.

The teachings of LaBate, while sufficient to solve the thermal flaking problem, are not applicable to the effective creation of an electrically conductive coating on a nonconductive refractory stopper. LaBate's invention contains too much nonconducting binding materials.

Not only is the amount of the binder not conducive to electrical conductivity, but

the nature of the binders also inhibits the flow of electricity through LaBate's coating. LaBate teaches a coating formulation that is rich in soluble binders such as sodium silicate and carboxy vinyl polymer resin which, while excellent binders, are capable of surrounding and isolating the graphite particles in the coating. This effectively prevents the particle-to-particle contact of the graphite that is essential to the conduction of electricity.

This tendency of the LaBate binder system to encapsulate and electrically insulate the graphite in the coating also diminishes its potential as an electrical contact point. As the liquid binder dried and the non-conductive solid residue migrated to the exterior surface of the coating, it would develop an electrically insulating layer on the exterior surface of the coating. This electrically insulated layer would prevent the graphite coating from making an electrical contact with other electrically charged elements in the system.

Any attempt to apply LaBate to the problem of creating an electrically conductive stopper without novel and inventive modifications would fail for the reasons cited above. LaBate does not recite or suggest such necessary modifications as is recited in the applicant's invention. For this reason, those skilled in the art would not find LaBate to be an obvious application to the problem of creating an electrically conductive refractory stopper.

The lack of implementation precludes obviousness.

As presented in the applicant's specification, the problems associated with using a clay-graphite refractory stopper to create an electric contact point and maintain an electrical current (e.g., high cost, difficult to produce, limited sources) were well known by those skilled in the industry. However, those problems remained

unsolved for more than twenty years.

LaBate's invention, which was patented on December 23, 1986, was well known by those skilled in the refractory and metal casting arts. But LaBate solved a different problem and solved it in a way that is contrary to the applicant's invention. Those skilled in the practice did not see an obvious application of LaBate nor did they recognize an obvious modification within or a adaptation of LaBate. Therefore, the applicant respectfully submits that the applicants invention, as amended, is not obvious and is patentable over LaBate.

Conclusion

The Examiner has demonstrated an excellent grasp of the technology surrounding this invention and has been extremely helpful in educating the applicant as to the intricacies of the patent application process. With his guidance and constructive inputs, the above amendment has been constructed.

The applicant submits that, for all reasons given above, the rewritten claims comply with 37 CFR 1.75(c), the claims define over the prior art under Section 102 a coating structure that is distinct from the prior art, such as the patent of LaBate that was cited by the Examiner, and the claimed distinctions are of patentable merit under Section 103 because the new result of an electrically conductive coating that can make an electrical contact with other electrically charged elements in the system was neither taught nor anticipated nor suggested by LaBate. Accordingly, the applicant submits that this application is now in condition for allowance, which action the applicant respectfully solicits.

Conditional Request For Constructive Assistance

Applicant has amended the claims of this application so that they are proper, definite, and define

novel structure which is also unobvious. Therefore it is submitted that patentable subject matter is clearly present. If, for any reason this application is not believed to be in full condition for allowance, applicant respectfully requests the constructive assistance and suggestions of the Examiner in order that the undersigned can place this application in allowable condition as soon as possible and without the need for further proceedings.

If the Examiner agrees but does not feel that the present claims are technically adequate, applicant respectfully requests that the Examiner write acceptable claims pursuant to M.P.E.P. Section 707.07(j).

Very Respectfully,

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2005 June 11

Thomas J. Maskell

Thomas J. Maskell, Applicant